

~~DRAFT~~FINAL

WORK PLAN

with

QUALITY ASSURANCE PROJECT PLAN

for

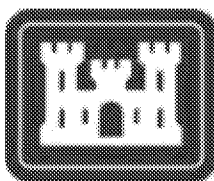
**SMALLMOUTH BASS ACOUSTIC TELEMTRY AND TISSUE
SAMPLING AND CRAYFISH TISSUE SAMPLING**

at

**River Operable Unit, Bradford Island
CASCADE LOCKS, OREGON**

Prepared by

U.S. ARMY CORPS OF ENGINEERS
Portland and Seattle Districts



~~June 26~~August 14, 2020

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TITLE AND APPROVAL SHEET
WORK PLAN WITH QUALITY ASSURANCE PROJECT PLAN (WP-QAPP)
SMALLMOUTH BASS ACOUSTIC TELEMETRY AND TISSUE SAMPLING AND
CRAYFISH TISSUE SAMPLING

RIVER OPERABLE UNIT, BRADFORD ISLAND, CASCADE LOCKS, OREGON

This Work Plan with Quality Assurance Project Plan (WP-QAPP) describes sampling activities and Data Quality Objectives (DQOs) for smallmouth bass and crayfish sampling at the River Operable Unit, Bradford Island, Cascade Locks, OR. The QAPP is based on the *Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans Guidance (EPA 2009)*.

Chris Budai, Project Manager, NWP

Date

Bill Gardiner, Sampling Technical Lead, NWS

Date

Alison M. Suess, Ph.D., Chemist, NWS

Date

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APPENDICIES

Appendix A: Summary of historic tissue results for bass and crayfish

Appendix B: Implementation Plan

Appendix C: Maps

Appendix D: Statistical Analysis —~~not included with draft; will be provided separately at a later date~~

Appendix E: Field Forms

Appendix F: Job Hazard Analysis (JHA) and supplemental COVID-19 information—~~not included with draft; will be available with FINAL QAPP~~

Appendix G. ERDC 153 Congeners with Detection Limits and Reporting Limits

Appendix H. Dry ice sample packing and shipping

LIST OF ACRONYMS

µg/L	microgram per liter
ARI	Analytical Resources, Inc.
CCB	continuing calibration blank
CCV	continuing calibration verification
CoC	chain of custody
CPR	cardiopulmonary resuscitation
DL	detection limit
DoD ELAP	Department of Defense Environmental Laboratory Accreditation
DoD QSM	Department of Defense Quality Systems Manual
DMC	deuterated monitoring compounds
EDD	electronic data deliverables
EPA	United States Environmental Protection Agency
GC-MS	gas chromatography mass spectroscopy
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICB	initial calibration blank
ICV	initial calibration verification
JHA	Job Hazard Analysis
LCS	laboratory control sample
mg/kg	milligram per kilogram
MS	matrix spike
MSD	matrix spike duplicate
ODEQ	Oregon Department of Environmental Quality
OU	Operable Unit
PCB	polychlorinated biphenyl
PDT	Project Delivery Team
POC	point of contact
PM	Project Manager
PQO	Project Quality Objectives
QC	quality control
RI	Remedial Investigation
RL	reporting limit
SLV	screening level value
SOP	Standard Operating Procedure
SSHP	Site Safety Health Plan
TAG	Technical Advisory Group
UCL	upper confidence limit
UPL	upper prediction limit
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
WP-QAPP	Work Plan with Quality Assurance Project Plan

1. PROJECT MANAGEMENT AND OBJECTIVES

1.1. Project Organization, Responsibilities and Authority

The Project Delivery Team (PDT) for this Work Plan with Quality Assurance Project Plan (WP-QAPP) includes members from the US Army Corps of Engineers (USACE) Portland and Seattle Districts as well as the US Geological Survey (USGS).

The project team provides the overall framework for the data collection approach by defining project objectives and data quality requirements, and ensuring that they are met during the execution of the project. Project updates will be shared with the Technical Advisory Group (TAG) who will be provided final copies of the WP-QAPP by the USACE Project Manager (PM). The roles of the project team members are described further in this section. Organization of the project is presented in Figure 1 and Table 1.

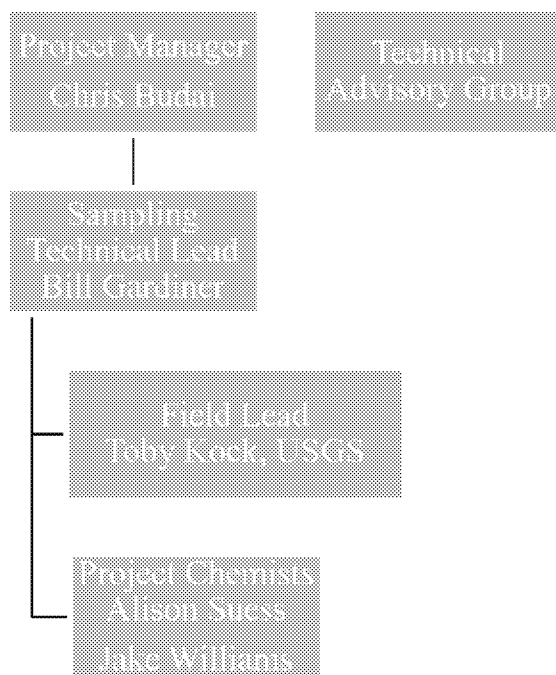


Figure 1. Project Organization Chart

Table 1. Project Organization and Distribution List

Personnel	Contact Information	Title
USACE		
Chris Budai	333 SW 1st Ave Portland, OR 97204 Phone: [Ex. 6 Personal Privacy (PP)] Email: christine.m.budai@usace.army.mil	Project Manager
Bill Gardiner	4735 E. Marginal Way S Seattle, WA 98134 phone: [Ex. 6 Personal Privacy (PP)] William.W.Gardiner@usace.army.mil	Technical Lead
Alison M. Suess, Ph.D. Jake Williams	4735 E. Marginal Way S Seattle, WA 98134 phone: [Ex. 6 Personal Privacy (PP)] alison.m.suess@usace.army.mil phone: [Ex. 6 Personal Privacy (PP)] Jacob.a.williams@usace.army.mil	Project Chemists (primary and backup)
Toby Kock	5501A Cook-Underwood Rd Cook, WA 98505 Phone: [Ex. 6 Personal Privacy (PP)] tkock@usgs.gov	Field Lead

1.1.1. Communication Pathways

Communication is a key to the success of this project. Communication pathways describe the points of contact for resolving sampling and analysis problems, for distributing data to users, soliciting concurrence and obtaining approval between project personnel and contractors. Communication pathways are summarized in Table 2~~Table 2~~.

Table 2. Communication Pathways

Communication Driver	Responsible Entity	Name Phone Number	Procedure (timing, pathway, etc.)
USACE management for this project Overall direction and Point of Contact for public	Project Manager	Chris Budai Ex. 6 Personal Privacy (PP)	Assures that the overall direction of the project is consistent with USACE guidance Liaison with the Public
QAPP approval Schedule, budget and technical issues Changes to schedule and budget Oversight of final report Provides coordination among team members Ensures compliance with Site USGS Safety Plan and AHA (or another USACE representative) Delivery of samples to laboratory (or another USACE representative)	Technical Lead	Bill Gardiner Ex. 6 Personal Privacy (PP)	Coordinates with Project Manager, Project Lead, Chemist and Field Lead on project technical issues Reports to USACE PM regarding schedule, budget, and technical issues Notifies USACE PM of significant changes in execution or schedule Oversee USACE writing of final report and distribution to reviewers Provides input to QAPP and data reports Briefs field team on AHA and documents noncompliance Coordinates with Project Chemist and laboratory for sample delivery
Writes QAPP with input from technical team members. Laboratory and data validation	Project Chemists	Alison M. Suess, Ph.D. Ex. 6 Personal Privacy (PP) Jake Williams Ex. 6 Personal Privacy (PP)	Oversees writing of QAPP and Job Hazard Analysis (JHA) and ensures revision approval within agreed timeframe Oversees laboratory work Writes data validation report Provides laboratory and data validation components of QAPP
Provide direction to field teams on sample collections Sampling activities summary	Field Lead	Toby Kock Kristen Kerns Ex. 6 Personal Privacy (PP)	Daily communication with team members during sampling events Documents all field activities in Final Monitoring Report Coordinates with Project Chemist

1.1.2. USACE Personnel Responsibilities and Qualifications

USACE Project Manager

The project manager (PM), Chris Budai, is responsible for the execution of the scope, schedule, and budget for the Bradford Island project. She is the primary POC for communications with stakeholders. The USACE PM also has the authority to stop work of USACE staff. The USACE PM is the primary document controller for the WP.

USACE Technical Lead

The Technical Lead, Bill Gardiner, will oversee all activities of the USGS and USACE PDT, including quality assurance reviews, and maintain regular coordination to ensure adequate and timely flow of information for all work. The technical lead, or another USACE representative in the field, will serve as the site safety and health officer (SSHO) for this effort and ~~provide~~ coordinate daily field safety briefings.

USACE Project Chemists

The Project Chemist, Alison M. Suess, Ph.D. (backup: Jake Williams) is directly responsible for laboratory coordination and matters related to chemistry. They are responsible for providing additional guidance to the Field Sampling Lead (Toby Kock) in any matters relating to sampling, project chemistry and data quality.

Field Sampling Lead/Site Health and Safety Officer

Toby Kock and Kristen Kerns ~~are~~ is the designated field sampling lead. ~~He~~ They ~~are~~ is responsible for coordinating the sampling with relevant Bonneville Project staff and execution of sampling. ~~He~~ They ~~may~~ communicate directly with the PM, Technical Lead, and Project Chemists as needed during the field sampling event.

Special Training Requirements and Certifications

Project staff shall be qualified to perform their assigned jobs. Field sampling personnel conducting or monitoring sampling activities are to be trained by the field sampling lead in accordance with established USACE protocols.

Field Staff

All project staff participating in on-site field activities shall have current HAZWOPER training in accordance with 29 Code of Federal Regulations (CFR) Part 1910.120, or be directly supervised by personnel with current HAZWOPER training. The technical lead and/or field sampling lead has HAZWOPER training in accordance with the same standard as well as a current certification in first aid and CPR. All field personnel responsible for packing and shipping samples using dry ice also have training and certification in accordance with 49 CFR 172.704 and the IATA Dangerous Goods regulation.

Laboratory Contact

The analytical laboratories and applicable information that will be used for this project are listed below. In [Table 3. ~~Error! Not a valid bookmark self-reference.~~](#)

Table 3. Analytical Laboratories, Contacts, and Analyses

Lab Name and Sample Type	Lab Address	POC	Contact Info	Role
U.S. Army Engineer Research and Development Center (ERDC) <u>Bass and Crayfish Samples</u>	USACE ERDC EL EPC B3299 3909 Halls Ferry Road Vicksburg, MS 39180	Primary: Jenifer Milam Netchaev	Jenifer.m.netchaev@erdc.dren.mil Jenifer.m.netchaev@usace.army.mil <small>Ex. 6 Personal Privacy (PP)</small>	Project Manager, Research Chemist
		Alternate: Tony Bednar	Anthony.J.Bednar@usace.army.mil <small>Ex. 6 Personal Privacy (PP)</small>	Laboratory Director, Research Chemist
<u>Analytical Resources, Inc. (ARD)</u> <u>Bait Samples</u>	<u>Analytical Resources, Inc.</u> 4611 S. 134th Place, Suite 100 Tukwila, WA 98168-3212	<u>Kelly Bottem</u>	<u>kelly.bottem@arilabs.com</u> <small>Ex. 6 Personal Privacy (PP)</small>	<u>Client Services Manager</u>

1.1.3. Technical Advisory Group Personnel Responsibilities and Qualifications

TAG members represent their respective agencies and provide technical review of the QAPP.

1.2. Project Planning

1.2.1. Project Planning (Scoping)

Several planning meetings were held within USACE and with TAG members. Topics discussed in these meetings include:

- Schedule
- Sampling Design and Data Collection
- Analytes

The outcomes of the meetings are documented by incorporation into this WP-QAPP.

1.2.2. Problem Definition, Site History, and Background

USACE conducted a Remedial Investigation and draft Feasibility Study for the in water portion of Bradford Island, known as the River Operable Unit (OU), in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 Executive Order 12580. As part of the Feasibility Study process, USACE conducted a baseline risk assessment, which found

unacceptable risk to human health and the environment from exposure to PCB contaminated sediment in the River OU.

~~The 2012~~Field efforts performed between 2006 and 2011 in support of the Remedial Investigation reported that 38 sampled smallmouth bass and had found elevated levels of PCBs in some of these fish. PCBs in crayfish tissues from the Site were also elevated, relative to the reference area (Appendix A). ~~and these elevated levels were also present in crayfish.~~ Subsequent tissue sampling conducted in 2011 also ~~saw elevated tissue concentrations.~~ During the feasibility study, USACE conducted supplemental passive porewater sampling and sediment trap deployment in 2017 and 2018. This sampling effort included underwater video survey, with ~~underwater images of the river bottom along the northern shoreline of Bradford Island~~, showing minimal sediment and large cobbles and boulders. This lack of sediment raised concern regarding the continued presence of contaminated sediment and the validity of the CSM developed in support of the FS. Subsequently, USACE began collecting data to update the CSM for the River OU. The intent of this data is to help inform the current site conditions for the River OU to aid in development of remedial action alternatives in the feasibility study

In 2020, USACE conducted additional in-situ porewater sampling to better understand the location of potential primary source contamination along the northern shoreline of Bradford Island. As part of the reevaluation and update to the CSM, tissues of fish and invertebrates are being sampled for chemical analysis. Bass represent an important resident prey species for human health via the fish ingestion pathway. Crayfish and clams are both important invertebrate species with limited home range that provide a localized estimate of uptake, food web transfer, and source.

This QAPP provides the approach and methods for sampling and analysis of bass and crayfish. Based on the length of time since previous fish sampling, USACE believes more current fish tissue sampling and tracking is needed to help inform the conceptual site model for the River OU and understand where bass exposure may be occurring. Crayfish will be also collected during this effort.

USACE has contracted with the USGS to collect ~~crayfish and smallmouth bass~~ and crayfish samples for tissue analysis and tagging and to evaluate the movements of smallmouth bass near Bonneville Dam using acoustic telemetry.

~~USACE is currently in the process of confirming and updating the conceptual site model for the River OU. The intent of this data is to help inform the current site conditions for the River OU to aid in development of remedial action alternatives in the feasibility study.~~

~~Historic tissue data results for both smallmouth bass and crayfish are provided in Appendix A.~~

1.3. Project Quality Objectives and Measurement Performance Criteria

1.3.1. Development of Project Quality Objectives Using the Systematic Planning Process

Project Quality Objectives (PQOs) are developed through the systematic planning process as described in the UFP-QAPP Guidance. PQOs specify the type, quantity, and quality of data needed to ensure that project data can be used for the intended purpose to answer specific environmental questions, support environmental decisions, and determine technical activities that will be conducted. The PQOs developed for this project are described in Table 4.

The overall goal of this tissue collection effort and telemetry is to update and confirm the conceptual site model presented in the Remedial Investigation. Given the amount of time since previous tissue sampling efforts in 2011, coupled with the recent visual observations of the complex river bottom along the northern shoreline of Bradford Island, USACE believes this effort is prudent to undertake as part of the feasibility study process to inform remedial alternative development and selection. The results of this data will be looked at comprehensively with other data associated with clam tissue, passive sampling, and future sediment sampling. In light of the length of time since previous sampling efforts, this data may be used to update the risk assessment and provide current risk communications to tribal and recreational fishers in the area. The intent is not to redo the baseline risk assessments, but supplement the dataset to reflect current conditions.

The analytes for analysis in tissues were selected primarily based on their high dominance in the conceptual site model and contribution to Site risks as risk drivers. PCBs provide a direct indication of historical contamination at Bradford Island from the disposal of PCB containing transformers. PCB contamination has historically been identified in every sampled media at the site and also contributes a majority of risk to both ecological and human health receptors. Organochlorine pesticides were identified for analysis in tissue based on previous elevated concentrations in bass tissue that contributed a notable fraction to overall risk. However, there is uncertainty if the elevated concentrations are attributable to the conceptual site model to site exposures or the result of matrix interferences during analysis. As such, analysis for organochlorine pesticides for this field effort will help to confirm its role in the conceptual site model risk. Lastly, mercury is ubiquitous at elevated concentrations throughout this portion of the Columbia River. However, given previous industrial activities at the site and associated risk, current mercury concentrations will be evaluated as part of this effort.

The PQOs are written for only bass and crayfish. However, sSculpin will also be collected incidentally as part of angling and trap efforts then archived. Sculpin provide a more localized estimate of uptake into fish tissues and will be used to supplement the CSM. A QAPP amendment will be issued once additional funding becomes available and chemical analysis is deemed pertinent based on the results of the field effort and analysis of bass and crayfish.

Table 4. Project Quality Objectives

Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytic Approach	Step 6: Specify Performance or Acceptance Criteria	Step 7: Develop the Detailed Plan for Obtaining Data
1) Are there any significant differences in River OU (Site) bass or crayfish concentrations relative to the reference area concentrations?	<p>Evaluate <u>differences between tissue concentrations</u> differences for the <u>at the Site</u> versus reference area.</p> <p>Understand site concentrations and magnitude of impacts from the site relative to concentrations representative of un-impacted receptors.</p> <p>Update and <u>reconfirm conceptual site model</u>.</p>	<p>The evaluation will use results from the analysis of samples collected in the Site and analysis of <u>samples representative of reference concentrations collected the reference area</u>.</p> <p>Reference concentrations for bass will be determined by fish collected near Bonneville Dam that are from a separate population than those bass impacted by contamination from Bradford Island. Bass collected from previous sampling efforts (2011 and earlier) that represent reference population concentrations will also be compared. Information from other sampling efforts for bass in the Columbia River may also be considered.</p> <p>Reference concentrations for crayfish will be represented by composites collected upstream of Stevenson, WA.</p>	<p>Tissue samples will be analyzed for the analytes of interest.</p> <p>For bass, <u>sample locations</u> will focus on the northern shoreline of Bradford Island, Goose Island, and the Forebay up to RM 147. the Site and reference area.</p> <p>For crayfish, samples will be collected around Bradford Island, Goose Island, the Oregon shoreline, and upstream near Stevenson, WA.</p>	<p>Statistical comparison between Site versus reference <u>value(s) to determine significant differences</u>.</p> <p>Visual evaluation of data and statistical outlier test.</p>	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).
2) Are there any changes in <u>tissue concentrations for bass or crayfish collected from the Site over time to Site bass or crayfish tissue concentrations</u> ?	<p>Evaluate <u>changes in tissue concentrations of target analyte</u> tissue changes at the Site for bass and crayfish collected during 2006 (Site), 2007/2008 (reference), and 2011 and tissue collected in 2020.</p> <p><u>Confirm current conditions relative to previous information in order to update the conceptual site model</u>.</p>	<p>The evaluation will use results from the analysis of samples collected in the Site in 2020 relative to samples collected between 2006 and 2011. Potential temporal changes at for the reference <u>concentrations/area</u> will also be assessed.</p>	<p>Tissue samples will be analyzed for analytes of interest.</p> <p>Sample locations will focus on the Site and reference <u>concentrations/area</u>.</p> <p>Historic data includes collection efforts in 2006 (Site), 2007/2008 (reference), and 2011 relative to the 2020 sampling effort.</p>	Statistical comparison for data collected over time, both RI and post RI data.	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).

Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytic Approach	Step 6: Specify Performance or Acceptance Criteria	Step 7: Develop the Detailed Plan for Obtaining Data
3) Where are bass potentially exposed to PCB contaminated sediment in the Site? <u>How do bass move through different parts of the Site? —How do bass move between different areas of the site, including the north shore of Bradford Island and Goose Island?</u>	Evaluate movement of bass as an indicator of where PCB exposure may occur.	The evaluation will use results from acoustic telemetry of approximately 40 smallmouth bass tracked in the Site.	Bass within the Site will be tracked with acoustic telemetry. Initial capture locations for tagging will be focused in the Site.	Telemetry data analyzed using SAS Statistical Software.	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).

Table 5. Sample Locations, Media, Methods, Analytes of Interest, and Detection and Reporting Limits

Sample Locations and Media	Method	Analytes	Tissue DL	Tissue RL
Forebay Site and Reference Area Bass and Crayfish Tissue	PCB Congeners, EPA 8082 Modified (ERDC) with subset EPA 1668C (ERDC commercial subcontractor)	153 PCB congeners (ERDC) with subset 209 PCB congeners (ERDC commercial subcontractor)	0.015 - 0.075 (µg/kg ww) (ERDC)	0.10 - 0.03 (µg/kg ww) (ERDC) with subset 0.20 - 0.60 (µg/kg ww) (ERDC commercial subcontractor)
Forebay Site and Reference Area Bass and Crayfish Tissue; Bait	Organochlorine Pesticides, EPA 8081 (ERDC)	Organochlorine Pesticides	(µg/kg ww)	(µg/kg ww)
		2,4'-DDD	0.16TBD	0.5
		2,4'-DDE	0.16TBD	0.5
		2,4'-DDT	0.16TBD	0.5
		4,4'-DDD	0.16TBD	0.5
		4,4'-DDE	0.16TBD	0.5
		4,4'-DDT	0.16TBD	0.5
		alpha-BHC	0.16TBD	0.5
		beta-BHC	0.16TBD	0.5
		delta-BHC	0.16TBD	0.5
		gamma-BHC	0.16TBD	0.5
		alpha-Chlordane (cis)	0.16TBD	0.5
		gamma-Chlordane (trans)	0.16TBD	0.5
		Dieldrin	0.16TBD	0.5
		Endosulfan I	0.16TBD	0.5
		Endosulfan II	0.16TBD	0.5
		Endrin	0.16TBD	0.5
		Endrin Aldehyde	0.16TBD	0.5
		Methoxychlor	0.16TBD	0.5
Forebay Site and Reference Area Bass and Crayfish Tissue; Bait	Mercury, EPA 7474 (ERDC)	Mercury	1.0 (µg/kg ww)TBD	2.0 (µg/kg ww)
Forebay Site and Reference Area Bass and Crayfish Tissue	Total Lipids, Sulfo-Phospho-Vanillin Colorimetric Method (Van Handel 1985) (ERDC)	Total Lipids	0.001%TBD	0.002%
Bait	PCB Aroclors, EPA 8082 (ARI)	PCB Aroclors	1.06 – 2.37 (µg/kg ww)TBD	4.00 (µg/kg ww)TBD
Bait	Organochlorine Pesticides, EPA 8081 (ARI)	Organochlorine Pesticides	0.0928 – 0.780 (µg/kg ww)	1.00 – 2.00, Methoxychlor 10.0 (µg/kg ww)
Bait	Mercury, EPA 7471 (ARI)	Mercury	0.000420 mg/kg	0.00500 mg/kg

Table 6. Sampling Summary (Number of Primary and Quality Control Samples)¹

Matrix	Analyses	Primary Samples	Field Duplicate Samples ²	MS/MSD ³	Total Number of Field Samples
Forebay Site and Reference Area Bass Tissue	PCB Congeners	80	8	4/4	96
	Organochlorine Pesticides	80	8	4/4	96
	Mercury	80	8	4/4	96
	Total Lipids	80	8	0	88
Forebay Site and Reference Area Crayfish Tissue	PCB Congeners	40	4	2/2	48
	Organochlorine Pesticides	40	4	2/2	48
	Mercury	40	4	2/2	48
	Total Lipids	40	4	0	44
Bait (for bass and crayfish)	PCB Aroclors	2	0	2/2	6
	Organochlorine Pesticides	2	0	2/2	6
	Mercury	2	0	2/2	6

1. Does not include laboratory quality control samples such as laboratory duplicates and control spikes. The mass required provided by the laboratory and listed in Table 109 includes sufficient mass for all field and laboratory quality control samples.

2. Field duplicate samples will be collected at a rate of 1 per 10 primary samples.

3. MS/MSD samples will be collected at a rate of 1 pair per 20 primary samples.

1.3.2. Measurement Performance Criteria

Performance criteria specify the acceptable levels of uncertainty in measured data that can be used to support project decisions and achieve PQOs. Performance criteria for the analytical methods are specified in the laboratory procedures and are compliant with DoD QSM 5.1 unless otherwise noted. Any data which fall outside of these criteria must be justified, and the effects on decisions must be assessed.

1.4. Secondary Data Evaluation

No secondary data will be collected.

1.5. Project Overview and Schedule

Through project planning, the project team has agreed on the purpose of the project, the environmental questions that are being asked, and the environmental decisions that must be made. Table 7 provides a summary of the project tasks to be completed and Table 8 describes the project schedule. The field schedule is partially dictated by spill operations at Bonneville Dam. The northern shoreline of Bradford Island is within the portion of the forebay designated as a Boating Restriction Zone (BRZ). During spill operations, no boat traffic is permitted within this portions of the site. Thus, sample collection in the BRZ is limited to the months of September to April.

Table 7. Project Tasks

Plan, Prepare WP-QAPP & Obtain Laboratory Quote
<ul style="list-style-type: none"> • Prepare and finalize WP-QAPP; obtain laboratory quotes.
Sampling Tasks
<ul style="list-style-type: none"> • Collect reference area bass and crayfish • Collect River OU Site bass and crayfish • Tag bass for acoustic telemetry
Analytical Tasks
<ul style="list-style-type: none"> • Chemical analysis of bass and crayfish tissue • Data collection and analysis of acoustic telemetry
Quality Control Tasks
<ul style="list-style-type: none"> • Chemical analytical methods QC will comply with DoD QSM or laboratory SOPs as applicable.
Secondary Data
<ul style="list-style-type: none"> • No secondary data will be collected.
Data Management Tasks
<ul style="list-style-type: none"> • Project Chemists will review and store analytical chemistry data. • USGS will review and store acoustic telemetry data.
Documentation and Records
<ul style="list-style-type: none"> • Field notes will be recorded in a field notebook or on field log sampling sheets, then scanned and electronically stored. • Field notes will contain the following: date and time of sample collection, weather conditions, sample identification number, type of sample, any procedural steps taken that deviate from those outlined in this WP-QAPP. • Laboratory analytical results will be stored.
Data Validation and Data Packages
<ul style="list-style-type: none"> • 100% of chemistry data packages will be validated through Stage 2A by the Project Chemists. All data packages will be delivered in sufficient detail to support the data validation.
Data Review Tasks
<ul style="list-style-type: none"> • The laboratory performing chemical analyses of samples will verify that all data are complete for samples received. • Chemical data will be validated using the principles of the <i>USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (2008)</i>. • Validated data will be reviewed. • Data usability will be assessed. • Measurement performance criteria set in WP-QAPP checked. • Data limitations will be determined. Data compared to PQOs.

Table 8. Estimated Project Schedule

Task #:Description	Start	Finish
Task #1: Plan, Prepare WP-QAPP and Obtain Laboratory Quotes		
Prepare Draft WP-QAPP	1 May 2020	30 June 2020
TAG Review	1 July 2020	30 July 2020
Finalize WP-QAPP	1 August 2020	15 August 2020
Obtain laboratory quote, finalize, and receive sample containers	1 June 2020	15 August 2020
Purchase Field Equipment	1 July 2020	30 July 2020
Task #2: Field Work		
Reference area Area outside BRZ	15-24 August 2020	31 August 2020
River OU Area within BRZ (BRZ permit required)	1 September 2020	30 September 2020

Task #:Description	Start	Finish
Task #3: Review Data and Prepare Report		
Receive Data Deliverable from Lab	1 November 2020	1 November 2020
Data Validation	1 November 2020	30 December 2020
Receive Data from USGS for Acoustic Telemetry	31 December 2020	30 April 2021
Draft and Final Data Reports	1 January 2021	30 June 2021

2. DATA GENERATION AND ACQUISITION

2.1. Sampling Tasks

Sample identification and field sampling will be performed following the protocols described in this section. Contingencies may arise during activities that will require modification of the general procedures outlined herein. Such modifications will be at the discretion of the field lead after consultation with the study technical lead and PM, the boat captain, and sampling team in the field. All modifications will be recorded and document in the field or data report, as appropriate.

2.1.1. Sampling Process Design and Rationale

The USGS will be leading the sample collection effort for both tissue collection for chemical analysis as well as capture and tagging of smallmouth bass. Appendix B provides the implementation plan for those field sampling efforts. USACE staff will be on site to support the USGS, particularly for processing of tissue for shipment to the laboratory for chemical analysis.

Reference Tissue

For smallmouth bass, both Site and reference bass will be collected in the immediate area of Bonneville Dam. The intent is to increase potential catch numbers in the area closest to Bradford Island. Based on previous sampling conducted in 2011 and earlier, it is possible that two distinct populations of bass are present in the Bonneville dam area; those exhibiting contamination likely obtained from Bradford Island and those not/less impacted by contamination at Bradford Island. See section 2.1.2 and Appendix C for additional information.

Given the approach to collect reference tissue for bass in the same general vicinity as Site fish impacted by Bradford Island, the results will need to be evaluated both statistically, visually, and against existing datasets representative of reference or background concentrations. ProUCL will be used to visually represent the data and statistically evaluate the dataset for outliers. Any outliers are assumed to be representative of impacts from Bradford Island contamination. Based on previous collection efforts, it is possible that bass of elevated concentration will be captured near Goose Island. While areas of collection are not necessarily indicative of the source of contamination for bass, fish captured from Goose Island will initially be evaluated separately from the Bradford Island bass. If telemetry data indicate frequent movements from Bradford Island to the Goose Island area or if other media indicate there are no contamination sources from the Goose Island area – the interactions between the two areas will be evaluated. Previous datasets associated with Bradford Island fish collection and other nearby fish

collection studies in the Columbia River will also be referenced to identify concentrations that appropriately represent a reference concentration. Bass collected as part of this field effort will be statistically compared to those reference concentrations.

Crayfish tissue for purposes of establishing reference concentrations will be collected upriver of Stevenson, Washington. This is the same general location targeted in previous sampling efforts for reference tissue. However, sampling stations will be located immediately upstream of the previous reference collection locations were identified in an attempt to avoid potential contamination from industrial facilities located within Stevenson, Washington, and within Cascade Locks, Oregon. See section 2.1.2 and Appendix C for additional information.

2.1.2. Sample Collection Procedures

Sample collection will be led by the USGS. An Implementation Plan describing collection procedures for both smallmouth bass and crayfish is included in Appendix B.

Target species for capture are the smallmouth bass and signal crayfish. Sexually mature bass are typically represented by a total length ranging from 150 to 400 mm. Bass of this size will be targeted for chemical sampling and telemetry. However, bass out of this range may also be retained, especially if abundance is low. An effort will be made to tag bass proportionally throughout the size range. For crayfish, any size retainable in the traps are considered suitable for chemical analysis.

Any sculpin species (*Cottis* spp) that are incidentally captured via angling or traps will be retained and archived for potential future analysis. Consistent with RI sampling, sculpin 75 to 150 mm in size will be targeted, but individuals outside this range may also be retained if abundance is low. Any sculpin, not retained will be returned to the river with minimum handling.

Non-target species captured via angling or trap will be document, identified as juvenile or adult, then released with minimal handling.

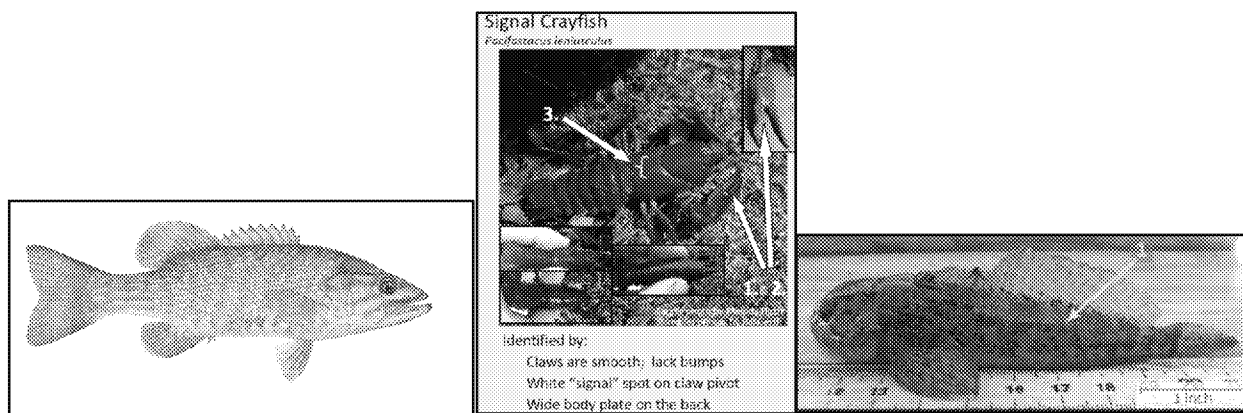


Figure 2. Smallmouth bass (left), and signal crayfish (center-right), and sculpin (right) (photo source: <https://www.dfw.state.or.us/>)

Bradford Island and Reference Sampling Locations

Target collection locations for angling are along the northern shoreline of Bradford Island, in the vicinity of Goose Island, and in the forebay immediately adjacent and upstream of those areas, in the River OU (Site) and reference area. As indicated in Appendix C, fishing effort will be focused on the northern shore of Bradford Island, Goose Island, and to a lesser extent the southern portion of Bradford Island and the Oregon shoreline. Maps in Appendix C indicate the areas of focus for angling efforts and the targeted number of smallmouth bass in each of those areas. However, fishing effort may be adjusted based on the locations of fish and catch success in the event that targeted numbers cannot be achieved. Information from historic collection efforts will be used to help guide staff to where successful collection previously occurred. Maps of target areas for collection of smallmouth bass and crayfish are provided in Appendix C.

For crayfish, traps will be placed at the approximate locations indicated in Appendix C. The GPS coordinates for the centroids of these trap locations are presented in Table 9. These locations are approximate and may need to adjust based on field conditions and catch success.

Table 9. Approximate GPS coordinates for crayfish traps at Reference and Site

<u>Reference Area</u>			<u>Site</u>		
<u>Sample Number</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Sample Number</u>	<u>Latitude</u>	<u>Longitude</u>
<u>1</u>	<u>45°41'57.691"N</u>	<u>121°52'10.749"W</u>	<u>21</u>	<u>45°38'41.049"N</u>	<u>121°55'36.609"W</u>
<u>2</u>	<u>45°41'55.33"N</u>	<u>121°52'11.945"W</u>	<u>22</u>	<u>45°38'39.329"N</u>	<u>121°55'35.072"W</u>
<u>3</u>	<u>45°41'57.142"N</u>	<u>121°52'13.866"W</u>	<u>23</u>	<u>45°38'37.553"N</u>	<u>121°55'39.429"W</u>
<u>4</u>	<u>45°41'56.681"N</u>	<u>121°52'16.79"W</u>	<u>24</u>	<u>45°38'36.436"N</u>	<u>121°55'43.101"W</u>
<u>5</u>	<u>45°41'54.791"N</u>	<u>121°52'17.089"W</u>	<u>25</u>	<u>45°38'38.124"N</u>	<u>121°55'44.699"W</u>
<u>6</u>	<u>45°41'55.595"N</u>	<u>121°52'19.696"W</u>	<u>26</u>	<u>45°38'25.349"N</u>	<u>121°55'58.601"W</u>
<u>7</u>	<u>45°41'54.705"N</u>	<u>121°52'22.548"W</u>	<u>27</u>	<u>45°38'20.727"N</u>	<u>121°56'9.629"W</u>
<u>8</u>	<u>45°41'54.05"N</u>	<u>121°52'20.421"W</u>	<u>28</u>	<u>45°38'16.742"N</u>	<u>121°56'26.146"W</u>
<u>9</u>	<u>45°41'53.347"N</u>	<u>121°52'22.969"W</u>	<u>29</u>	<u>45°38'26.972"N</u>	<u>121°56'16.019"W</u>
<u>10</u>	<u>45°41'51.207"N</u>	<u>121°52'24.276"W</u>	<u>30</u>	<u>45°38'27.908"N</u>	<u>121°56'9.872"W</u>
<u>11</u>	<u>45°41'50.084"N</u>	<u>121°52'26.347"W</u>	<u>31</u>	<u>45°38'32.103"N</u>	<u>121°56'4.296"W</u>
<u>12</u>	<u>45°41'50.726"N</u>	<u>121°52'29.989"W</u>	<u>32</u>	<u>45°38'33.358"N</u>	<u>121°56'5.247"W</u>
<u>13</u>	<u>45°41'49.26"N</u>	<u>121°52'29.128"W</u>	<u>33</u>	<u>45°38'34.748"N</u>	<u>121°56'6.133"W</u>
<u>14</u>	<u>45°41'49.045"N</u>	<u>121°52'32.752"W</u>	<u>34</u>	<u>45°38'34.851"N</u>	<u>121°56'8.093"W</u>
<u>15</u>	<u>45°41'47.382"N</u>	<u>121°52'31.406"W</u>	<u>35</u>	<u>45°38'35.513"N</u>	<u>121°56'10.034"W</u>
<u>16</u>	<u>45°41'48.057"N</u>	<u>121°52'33.401"W</u>	<u>36</u>	<u>45°38'34.552"N</u>	<u>121°56'12.362"W</u>

<u>17</u>	<u>45°41'46.309"N</u>	<u>121°52'33.802"W</u>	<u>37</u>	<u>45°38'34.974"N</u>	<u>121°56'14.664"W</u>
<u>18</u>	<u>45°41'45.754"N</u>	<u>121°52'35.738"W</u>	<u>38</u>	<u>45°38'33.991"N</u>	<u>121°56'16.9"W</u>
<u>19</u>	<u>45°41'44.518"N</u>	<u>121°52'35.368"W</u>	<u>39</u>	<u>45°38'34.906"N</u>	<u>121°56'18.8"W</u>
<u>20</u>	<u>45°41'43.236"N</u>	<u>121°52'37.331"W</u>	<u>40</u>	<u>45°38'34.147"N</u>	<u>121°56'20.295"W</u>

Smallmouth Bass Stomach Contents

Immediately following capture and euthanasia of bass, stomach content of each individual bass will be obtained via ~~stomach flushing methods~~gastric lavage. Stomach content from each fish will be individually collected in a metal strainer then placed in a labeled sample jar. Samples will be archived for potential future analysis.

Crayfish Bait

Before use, a representative samples of bait (worms, canned cat food, tuna, frozen shad, etc.) used in the crayfish traps and for bass collection will be analyzed for PCB Aroclors, organochlorine pesticides, and total mercury. The bait will not be used if detectable levels of PCB Aroclors are observed. For canned bait, every effort will be made to use cans with a single lot number. The canned bait will be punctured with a designated stainless steel knife and placed within each trap immediately before deployment.

Chemical Analysis

For chemical analysis, smallmouth bass will be analyzed as individual samples, and no compositing is anticipated. Crayfish will be composited to achieve a minimum biomass of 80 g needed for all chemical analyses, approximately 3 crayfish. All specimen will be wrapped in aluminum foil, double bagged, labeled, and placed on ~~wet~~ dry ice for shipment to the laboratory. The goal is to collect ~~40-80~~ smallmouth bass in the Site for chemical analysis, and another 40 smallmouth bass in the reference area. Statistical analysis to support the target collection numbers is provided in Appendix D. The target numbers for crayfish in the Site and reference area are 20 separate composites (comprised of 3 crayfish per composite) for each area. The targeted numbers for sculpin in the Site and reference area are 20 individual specimens. Depending upon sculpin size, numbers collected, and chemical analytes, compositing may be required.

2.1.3. Sample Naming Convention

Bass, ~~and~~ crayfish, ~~and~~ sculpin will be given an identification for each sample (or composite). The naming convention will include initials for the ~~include identification of whether the sample is from the Site ("BI") or reference area ("REF"), date of collection,~~ specimen type (SB=smallmouth bass; CF=crayfish; SC=sculpin), a number indicating the boat crew (1, 2, etc.), and a 3-digit sample/composite number (001, 002, 003, etc.). Field duplicate samples will end in "FD", and matrix spike and matrix spike duplicate samples will end in "MS" and "MSD", respectively.

Examples:

SB1001BI-2Sep2020-SB01 (primary sample)

SB1001BI-2Sep2020-SB01FD (field duplicate associated with primary sample #1)

SB1001BI-2Sep2020-SB01MS (matrix spike associated with primary sample #1)

SB1001BI-2Sep2020-SB01MSD (matrix spike duplicate associated with primary sample #1)

Table 910. Methods, Sample Containers, Volumes, Preservation, and Holding Times for Crayfish and Smallmouth Bass Tissue Samples

Analytes	Analytical Method	Container Type/Quantity	Preservation	Minimum Mass per Sample ¹ (g)	Holding Time (ERDC)
PCB congeners	EPA 8082 Modified (ERDC) with subset EPA 1668C (ERDC commercial subcontractor)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	40	Thawed: 14 days Frozen: 1 year
Organochlorine Pesticides	EPA 8081 (ERDC)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	30	Thawed: 14 days Frozen: 1 year
Mercury	EPA 7474 (ERDC)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	6	Thawed: 14 days Frozen: 1 year
Total Lipids	Sulfo-Phospho-Vanillin Colorimetric Method (Van Handel 1985) (ERDC)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	3	Thawed: 14 days Frozen: 1 year

1. Tissue mass listed includes all laboratory and field quality control samples, such as blank, duplicate, LCS/LCSD, MS/MSD, and potential re-extraction.

2.1.4. Decontamination Procedures

All potential sources of contamination in the field will be identified by the field lead, and appropriate steps will be taken to minimize or eliminate contamination. Ice chests will be scrubbed clean with Alconox® or Liquinox® detergent and rinsed with distilled water after use to prevent potential cross contamination. To avoid contamination from melting ice, the ~~wet-dry~~ ice will be placed in separated plastic bags from samples by placing all samples in large plastic bags. Prior to each use, sampling equipment will be cleaned with Alconox® or Liquinox® phosphate-free detergent and rinsed with deionized water.

2.1.5. Field Equipment Calibration, Maintenance, Testing and Inspection Procedures

No field equipment requires calibration, maintenance, testing and inspection. If any sampling procedures are changed to include use of field equipment, that information will be included in the field notes.

2.1.6. Supply Inspection and Acceptance Procedures

Inspection and acceptance of supplies and consumables will be conducted prior to field work in order to ensure that the appropriate type and quantity of supplies are brought to the field. Any supplies and consumables used in the sample collection process or instrument calibration will be inspected.

2.1.7. Field Documentation Procedures

Field documentation provides a permanent record of field activities and can be used, if necessary, to trace possible introduction of field sampling error.

Field notes will be maintained either in a bound logbook, or on field sampling log sheets. After fieldwork is complete, electronic copies will be made of the field notes and the electronic copies will be stored in the project files. All information pertinent to the sampling effort will be recorded in the field notes. Documentation in the field notes will be at a level of detail sufficient to explain and reconstruct field activities without relying on recollection by the field team members. The Field Sampling Lead has overall responsibility for accuracy and completeness of field notes. Each page/form will be consecutively numbered. All entries will be made in indelible ink and corrections will consist of lined-out deletions. As a minimum, the applicable items for the entry into the field notes are listed below.

General Information

- Date
- Time
- Weather conditions
- Names of personnel present

Sampling Information

- Location of sample
- Type of sample
- Sample identification number
- Associated QC samples
- Any unusual observations

2.1.8. Sample Delivery

Sample delivery procedures include packaging, labeling, and shipment to the laboratory. These procedures are designed (1) to preserve sample quality so that analyses will yield results representative of site conditions, (2) to protect and inform sample handlers, including shippers and laboratory personnel, and (3) to provide a paper trail to allow cross referencing of sample collection locations with analytical results. See appendix H for dry ice sampling packing and shipping methods.

All samples will be shipped on dry ice. Dry ice will be supplied by the following vendor:

OXARC® Inc.
19310 NE San Rafael St, Portland, OR 97230
(503) 618-1625

Samples will be shipped from the nearest FedEx facility that accepts packages containing dry ice:

FedEx Ship Center
5159 NE Cornfoot Rd
Portland, OR 97218

All samples will be labeled with its own sample identification number and all other applicable information. Samples will be shipped with ~~wet~~ dry ice overnight via FedEx to the laboratory. To avoid

potential shipping delays, shipments for Thursday and Friday will be avoided and held in a freezer or on dry ice till the following Monday for shipment. The shipping address for the laboratory is:

USACE ERDC EL EPC B3299
3909 Halls Ferry Road
Vicksburg, MS 39180

2.1.9. Sample Custody

A sample is in “custody” if it is in the actual physical possession of authorized personnel or in a secure area that is restricted to authorized personnel. Custody procedures ensure data authenticity and defensibility. Chain of custody (CoC) forms will accompany sample containers during transit to the laboratory and be checked by the laboratory upon receipt.

2.2. Analytical Tasks

Once samples have been collected, they will be analyzed by the laboratories. The Project Chemists will validate the analytical data.

The following sections address all components of project-specific analytical measurements; method and laboratory-specific QC measurements; acceptance criteria; corrective actions; calibration procedures; equipment and supply maintenance; testing; and inspection requirements. Modifications to approved procedures, alternate procedures, or additional procedures are to be pre-approved in writing by the Project Chemist.

2.2.1. Analytical Methods

See Table 5 for analytical methods that will be used for analysis of tissue samples.

2.2.2. Analytical Instrument Calibration Procedures

Calibration procedures and instrumentation shall be consistent with the requirements of the methods.

2.2.3. Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures

Maintenance, testing, and inspection procedures shall be consistent with the requirements of the methods.

2.3. Quality Control Samples

Quality control (QC) samples are collected and analyzed for the purpose of assessing the quality of the sampling and analysis performed by the field personnel and the primary laboratory. The Project Chemist will coordinate selection of QC samples prior to each sampling event.

2.3.1. Field Quality Control Samples

2.3.1.1. Field Duplicates

Field duplicate samples will be collected at a rate of 1 per 10 primary samples. Field duplicate samples for tissue will be evaluated at 50% relative percent difference.

2.3.1.2. Trip Blanks

No trip blanks will be collected for this sampling event as they are not necessary for the selected methods.

2.3.1.3. Equipment Rinse Blanks

No equipment rinse blanks will be collected since there is no reusable sampling equipment such as scoops or containers utilized in bass and crayfish collection.

2.3.2. Analytical Method Quality Control Samples

Method QC includes the analyses and activities required to ensure that the analytical system is in control prior to and during an analytical run. Method QC requirements for this project include the following: method blanks, surrogate spikes, matrix spikes/matrix spike duplicate pairs, and laboratory control samples.

2.3.2.1. Method Blanks

Method blanks are composed of organic/analyte-free water processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure. Method blanks verify that the measurement system is free of contamination.

2.3.2.2. Laboratory Control Samples (LCS)

Laboratory control sample (LCSs) are composed of organic/analyte-free water spiked with verified amounts of analytes. They are ~~generally used to~~ evaluate accuracy and precision, including to establish intra-laboratory or analyst-specific precision or to assess the performance of all or a portion of the measurement system. The LCS is analyzed in the same manner as a sample, including preservation. Laboratory acceptance criteria will be used for evaluation of the results.

2.3.2.3. Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD samples are used to evaluate matrix interference and to determine laboratory accuracy and precision. For methods that require MS/MSDs, MS/MSD samples will be collected at a rate of 1 pair per 20 primary samples. Laboratory acceptance criteria will be used for evaluation of the results.

2.3.2.4. Surrogates

Surrogates are substances with properties that mimic the analyte of interest. A surrogate is unlikely to be found in environment samples, and is therefore added to them ~~for quality control purposes~~ to assess accuracy of the results. Laboratory acceptance criteria will be used for evaluation of the results.

3. ASSESSMENT AND OVERSIGHT

Laboratory and field operations have established policies and procedures, and they designate authorities for implementing corrective action when nonconforming work or departures from the policies and procedures in the quality system or technical operations have been identified. Both field and laboratory operations shall follow all corrective action requirements in methods and SOPs.

The following laboratory documentation is to be made accessible to the USACE Project Chemist. Corrective actions may be required, at the request of USACE, for the following conditions:

- Laboratory Procedures
- QC data outside the defined acceptance windows for precision or accuracy
- Blanks or LCS's that contain contaminants above acceptable levels stated in the Project Quality Objectives
- Undesirable trends in spike or surrogate recoveries or RPD between spiked duplicates
- Unusual changes in method detection limits
- Deficiencies identified during internal or external audits or from the results of performance

The following corrective actions should be taken for common problems:

Incoming Samples - Problems noted during sample receipt are to be documented. The USACE Project Chemist is to be notified for problem resolution.

Sample Holding Times - If a maximum holding time is or may be exceeded by the laboratory, the USACE Project Chemist must be notified for problem resolution. The USACE Project Chemists may require re-sampling for the requested parameters.

Instrument Calibration - Sample analysis may not proceed until initial calibrations meet method criteria. Calibrations must meet method time requirements or recalibration must be performed. Continuing calibrations that do not meet accuracy criteria should result in a review of the calibration, rerun of the appropriate calibration standards, and reanalysis of samples affected back to the previous acceptable calibration check.

Limit of Quantitation (LOQ) - Appropriate sample clean-up procedures must be employed to attempt to achieve the practical quantitation limits as stated in the method. If difficulties arise in achieving these limits due to a particular sample matrix, the laboratory should notify the USACE Project Chemists of the problem for resolution. Dilutions are to be documented in the case narrative along with the revised practical quantitation limits for those analytes directly affected. Analytes detected above the method detection limits (MDLs) but below the practical limit(s) of quantitation are to be reported as estimated values and qualified "J".

Method Quality Control - Results related to method QC, including blank contamination, duplicate measurement reproducibility, MS/MSD recoveries, surrogate recoveries, LCS recoveries, and other method-specified QC measures are to meet the laboratory's SOPs and PQOs specified in this plan. Otherwise, the affected samples may be reanalyzed and/or re-extracted and reanalyzed within method-required holding times to verify the presence or absence of matrix effects. In order to confirm matrix effects, QC results must observe the same direction and magnitude (ten times) bias. The USACE Project Chemist should be notified as soon as possible to discuss appropriate corrective action.

Calculation Errors - Reports must be reissued if calculation and/or reporting errors are noted with any given data package. The case narrative is to state the reason(s) for re-issuance of a report.

4. DATA MANAGEMENT AND DOCUMENTATION

4.1. WP-QAPP

An electronic copy of the WP-QAPP (including appendices) will be stored in USACE project files and provided to the Technical Advisory Group.

4.2. Final Report

Upon completion of the sampling event and receipt/review of the validated data, USACE will prepare a final report. The report may be issued separately, or as an appendix to a future report that addresses source control. The report will include the following:

- Narrative and timeline of project activities
- Summary of sampling, chemical testing, and any deviations from the QAPP
- Analytical data summary and discussion
- Figures, tables, and appendices

The appendices will include field logs, laboratory analytical reports, data validation reports, and data summary tables with associated validation flags.

4.3. Laboratory Documentation (Data Package Deliverables)

4.3.1. Data Package Deliverables

The analytical data packages from the laboratories will be provided to the Project Chemist in sufficient detail for the required level of data validation. The analytical data packages will be validated to Stage 2a by the Project Chemist for 100% of all samples analyzed by the laboratory.

4.3.2. Electronic Data Reporting Formats

Laboratory data will be accepted as a report in PDF format. An Excel electronic deliverable will also be provided. ~~Additional electronic data deliverables (EDD) are not required.~~

5. DATA REVIEW, VERIFICATION, AND VALIDATION

Data review is the process by which data are examined and evaluated to varying levels of detail and specificity by a variety of personnel who have different responsibilities within the data management process. It includes verification, validation, and usability assessment. This process ensures the review activities produce scientifically sound data that are of known and documented quality and meet PQOs used in making environmental decisions.

5.1. Review of Data

All laboratory data packages will include raw data necessary for full validation. Analytical data packages will be validated to Stage 2a by the Project Chemist for 100% of all samples analyzed by the contracted laboratory.

Three distinct evaluative steps will be used to ensure that project-specific data quality needs are met:

- Data Verification (review for completeness) – Confirmation by examination and provision of objective evidence that the specified requirements (sampling and analytical) have been completed.
- Data Validation – Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Validation is a sampling and analytical process that includes evaluating compliance with method, procedure, or contract requirements and extends to evaluating against criteria based on the quality objectives developed in the QAPP (e.g., the QAPP measurement performance criteria). The purpose of validation is to assess the performance of the sampling and analysis processes to determine the quality of specified data. Data Validation Reports will be generated for each sampling event.
- Data Usability Assessment – Determination of the adequacy of data, based on the results of validation and verification, and professional judgment by the Project Chemist, for the decisions being made. The usability step involves assessing whether the process execution and resulting data meet project quality objectives documented in the QAPP.

Data review will be based on laboratory-specific SOPs conforming to the method and applying the principles of the Department of Defense Data Validation Guidelines (DoD, 2019b, 2020a, 2020b), and where applicable and not in conflict, the National Functional Guidelines for Superfund Data Review (USEPA, 2016, 2017a, 2017b). If significant deviations arise as a result of initial verification and validation, the level of review will be elevated in order to determine the source and impact of deviations.

5.2. Data Verification and Validation Stages

Data validation and verification stages described below are in accordance with the Department of Defense Data Validation Guidelines (DoD, 2019b) and Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA, 2009).

5.2.1. Stage 1

Verification and validation begins with Stage 1 checks of the laboratory analytical data package consisting of compliance of sample receipt conditions, sample characteristics (e.g., percent moisture), and analytical results (with associated information). The following minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 1 validation label:

- (1) Documentation identifies the laboratory receiving and conducting analyses, and includes documentation for all samples submitted by the project or requested for analyses.
- (2) Requested analytical methods were performed and the analysis dates are present.
- (3) Requested target analyte results are reported along with the original laboratory data qualifiers and data qualifier definitions for each reported result (and the uncertainty of each result and clear indication of the type of uncertainty reported if required).
- (4) Requested target analyte result units are reported.
- (5) Requested reporting limits for all samples are present and results at and below the project-specific reporting limits are clearly identified (including sample detection limits if required).
- (6) Sampling dates (including times if needed), date and time of laboratory receipt of samples, and sample conditions upon receipt at the laboratory (including preservation, pH and temperature) are documented.
- (7) Sample results are evaluated by comparing sample conditions upon receipt at the laboratory (e.g., preservation checks) and sample characteristics (e.g., percent moisture) to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

5.2.2. Stage 2A

Stage 2A validation builds on the validation conducted in Stage 1. Stage 2A validation of the laboratory analytical data package consists of the Stage 1 validation plus the verification and validation checks for the compliance of sample-related QC. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 2A Validation label:

- (8) Requested methods (handling, preparation, cleanup, and analytical) are performed.
- (9) Method dates (including dates, times and duration of analysis for radiation counting measurements and other methods, if needed) for handling (e.g., Toxicity Characteristic Leaching Procedure), preparation, cleanup and analysis are present, as appropriate.
- (10) Sample-related QC data and QC acceptance criteria (e.g., method blanks, surrogate recoveries, deuterated monitoring compounds (DMC) recoveries, laboratory control sample (LCS) recoveries, duplicate analyses, matrix spike and matrix spike duplicate recoveries) are provided and linked to the reported field samples (including the field quality control samples such as trip and equipment blanks).

- (11) Requested spike analytes or compounds (e.g., surrogate, DMCs, LCS spikes) have been added, as appropriate.
- (12) Sample holding times (from sampling date to preparation and preparation to analysis) are evaluated.
- (13) Frequency of QC samples is checked for appropriateness (e.g., one LCS per twenty samples in a preparation batch).
- (14) Sample results are evaluated by comparing holding times and sample-related QC data to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

5.2.3. Stage 2B

Stage 2B validation builds on the validation conducted in Stage 2A. Stage 2B validation of the laboratory analytical data package consists of the Stage 2A validation plus the verification and validation checks for the compliance of instrument-related QC. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 2B Validation label:

- (15) Initial calibration data (e.g., initial calibration standards, initial calibration verification [ICV] standards, initial calibration blanks [ICBs]) are provided for all requested analytes and linked to field samples reported. For each initial calibration, the calibration type used is present along with the initial calibration equation used including any weighting factor(s) applied and the associated correlation coefficients, as appropriate. Recalculations of the standard concentrations using the initial calibration curve are present, along with their associated percent recoveries, as appropriate (e.g., if required by the project, method, or contract). For the ICV standard, the associated percent recovery (or percent difference, as appropriate) is present.
- (16) Appropriate number and concentration of initial calibration standards are present.
- (17) Continuing calibration data (e.g., continuing calibration verification [CCV] standards and continuing calibration blanks [CCBs]) are provided for all requested analytes and linked to field samples reported, as appropriate. For the CCV standard(s), the associated percent recoveries (or percent differences, as appropriate) are present.
- (18) Reported samples are bracketed by CCV standards and CCBs standards as appropriate.
- (19) Method specific instrument performance checks are present as appropriate (e.g., tunes for mass spectrometry methods).
- (20) Frequency of instrument QC samples is checked for appropriateness (e.g., gas chromatography-mass spectroscopy [GC-MS] tunes have been run every 12 hours).
- (21) Sample results are evaluated by comparing instrument-related QC data to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

5.2.4. Stage 3

Stage 3 validation builds on the validation conducted in Stage 2B. Stage 3 validation of the laboratory analytical data package consists of the Stage 2B validation plus the recalculation of instrument and sample results from the laboratory instrument responses, and comparison of recalculated results to laboratory reported results. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 3 Validation label:

- (22) Instrument response data (e.g., GC peak areas) are reported for requested analytes, surrogates, internal standards, and DMCs for all requested field samples, matrix spikes, matrix spike duplicates, LCS, and method blanks as well as calibration data and instrument QC checks (e.g., tunes).
- (23) Reported target analyte instrument responses are associated with appropriate internal standard analyte(s) for each (or selected) analyte(s) (for methods using internal standard for calibration).
- (24) Fit and appropriateness of the initial calibration curve used or required (e.g., mean calibration factor, regression analysis [linear or non-linear, with or without weighting factors, with or without forcing]) is checked with recalculation of the initial calibration curve for each (or selected) analyte(s) from the instrument response.
- (25) Comparison of instrument response to the minimum response requirements for each (or selected) analyte(s).
- (26) Recalculation of each (or selected) opening and closing CCV (and CCB) response from the peak data reported for each (or selected) analyte(s) from the instrument response, as appropriate.
- (27) Compliance check of recalculated opening and/or closing CCV (and CCB) response to recalculated initial calibration response for each (or selected) analyte(s).
- (28) Recalculation of percent ratios for each (or selected) tune from the instrument response, as appropriate.
- (29) Compliance check of recalculated percent ratio for each (or selected) tune from the instrument response.
- (30) Recalculation of each (or selected) instrument performance check (e.g., instrument blanks,) from the instrument response.
- (31) Recalculation and compliance check of retention time windows (for chromatographic methods) for each (or selected) analyte(s) from the laboratory reported retention times.
- (32) Recalculation of reported results for each reported (or selected) target analyte(s) from the instrument response.
- (33) Recalculation of each (or selected) reported spike recovery (surrogate recoveries, DMC recoveries, LCS recoveries, duplicate analyses, matrix spike and matrix spike duplicate recoveries) from the instrument response.

(34) Each (or selected) sample result(s) and spike recovery(ies) are evaluated by comparing the recalculated numbers to the laboratory reported numbers according to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

Note: Selection of analytes, spikes, and performance evaluation checks for the Stage 3 validation checks for a laboratory analytical data package being verified and validated generally will depend on many factors including (but not limited to) the type of verification and validation being performed (manual or electronic), requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract, the number of laboratories reporting the data, the number and type of analytical methods reported, the number of analytes reported in each method, and the number of detected analytes.

5.2.5. Stage 4

Stage 4 validation builds on the validation conducted in Stage 3. Stage 4 validation of the laboratory analytical data package consists of the Stage 3 validation plus the evaluation of instrument outputs. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 4 Validation label:

(35) All required instrument outputs (e.g., chromatograms, mass spectra) for evaluating sample and instrument performance are present.

(36) Sample results are evaluated by checking each (or selected) instrument output (e.g., chromatograms, mass spectra) for correct identification and quantitation of analytes (e.g., peak integrations, use of appropriate internal standards for quantitation, elution order of analytes, and interferences).

(37) Each (or selected) instrument's output(s) is evaluated for confirmation of non-detected or tentatively identified analytes.

Selection of instrument outputs for the Stage 4 validation checks for a laboratory analytical data package being verified and validated generally will depend on many factors including, but not limited to, the type of verification and validation being performed (electronic or manual), requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract, the number of laboratories reporting the data, the number and type of analytical methods reported, the number of analytes reported in each method, and the number of detected analytes.

5.3. Data Verification and Validation Stages

A data validation report will be generated by the USACE Chemist that encompasses the results of the manual review of private lab data. The data validation report will be an appendix to the Final Report. Professional judgment shall be used when deciding if qualification of data is applicable. When professional judgment is applied, the rationale shall be provided. Tables of qualified data and the reasons for qualification will also be included in the data validation report.

Qualifiers will be added to data during the review as necessary. Qualifiers applied to the data as a result of the review are as follows:

- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit. The data are usable for decision-making purposes.
- UJ Indicates the compound or analyte was analyzed for but not detected. Due to a quality control deficiency identified during data validation, the value reported may not accurately reflect the sample quantitation limit. The associated value is considered estimated, but the data are generally usable for decision-making purposes.
- J Indicates the compound or analyte was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. False positives or false negatives are unlikely to have been reported and the data are generally usable for decision-making purposes.
- J+ Data are qualified as estimated with a high bias. False positives are likely to occur but the data are generally usable for decision-making purposes.
- J- Data are qualified as estimated with a low bias. False negatives are likely to occur but the data are generally usable for decision-making purposes.
- X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified. Rejection of the data should be decided by the project team (which should include a project chemist).

Note: It is possible that J-qualified data are not suitable for some purposes. For example, a J-qualified concentration with a low bias that is just below a screening value may not be usable to determine whether the analyte concentration is above or below the screening value. The effect of the use of qualified data on the decision-making process must be evaluated as part of the “reconciliation with user requirements” process.

5.4. Usability Assessment

The Project Chemist will evaluate overall precision, accuracy, completeness, representativeness, comparability, and sensitivity of the sampling data; including an assessment of the overall usability of the data and describing any limitations on its use. The Project Chemist will summarize any audit information, indicating corrective actions taken. This information will be part of the data validation report, which is an appendix to the Final Report.

5.4.1. Precision

Precision is defined as the degree of agreement between or among independent, similar, or repeated measures. Duplicate pairs such as MS/MSD, LCS/LCSD, laboratory duplicate, and field duplicate samples are evaluated as RPD. The relative percent difference (RPD) for these analyses is calculated as follows:

$$RPD = \frac{|S_1 - S_2|}{S_{avg}} \times 100\%$$

Where S_1 and S_2 = the observed concentration of analyte in the sample and its duplicate, and

S_{avg} = the average of observed analyte concentration in the samples and its duplicate.

5.4.2. Accuracy

Accuracy is the amount of agreement between a measured value and the true value. Accuracy, expressed as %Recovery (%R), is assessed for each method, analyte, and matrix, by comparing MS, MSD, LCS, LCSD, and surrogate recoveries to the method limits.

5.4.3. Representativeness

Representativeness is a qualitative parameter that expresses the degree to which the sample data are characteristic of a population. Blank samples identify compounds that may have been introduced into the samples during preparation, or analysis. Representativeness is addressed by evaluating blank samples, sample custody, and holding times and temperatures.

5.4.4. Completeness

Analytical completeness is expressed as the percentage of measurements that were judged to be valid, i.e., not rejected, and acceptable for all intended data use.

5.4.5. Sensitivity

Sensitivity is the ability of an analytical method or instrument to discriminate between measurement responses representing different concentrations. The sensitivity of the analytical methods (i.e., method reporting limits) identified for this project are evaluated against the QAPP.

6. REFERENCES

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